Chapter 2
Alternatives

2.1 ALTERNATIVES ANALYZED IN THE HFBR EIS

DOE has identified four alternatives for the future of the HFBR. They are:

- No Action Alternative
- Resume Operation Alternative, which has subalternatives to operate at either 30 MW or 60 MW
- Resume Operation and Enhance Facility Alternative
- Permanent Shutdown Alternative

Regardless of which alternative is selected, DOE will comply with Article 12 of the Suffolk County Sanitary Code, and protect against any unplanned emissions of tritium that might contaminate the environment. These modifications are discussed in Section 2.3

2.1.1 NO ACTION ALTERNATIVE

Under this alternative, the HFBR would be maintained in the current shutdown and defueled condition for the indefinite future. The modifications and repairs discussed in Section 2.3 would be performed. DOE regards this as a non-preferred alternative because it does not resolve the future of the HFBR (62 FR 62572).

Spent fuel elements have been removed from the spent fuel pool and shipped to SRS for storage and final disposition; the final shipment was in September 1997. Water from the pool was transferred to storage tanks via existing double-walled piping used for routine transfers of radioactive water from the HFBR to the waste management facilities. The modifications described in Section 2.3 have been or will be performed. This is the reactor configuration against which the other alternatives will be compared in the following sections.

2.1.2 RESUME OPERATION ALTERNATIVE

The reactor would be restarted following the completion of the NEPA process. This alternative includes two Subalternatives.

2.1.2.1 30 MW Operation

Restart and operation of the reactor at a power level of 30 MW. This power level would be the same as the reduced level maintained before the shutdown (62 FR 62572).

Under this alternative, startup and resumption of operations at the reactor would be limited to 30 MW, the power level prior to the current shutdown. The HFBR would undergo the modifications described in Section 2.3. Once the modifications are complete, it would be at least another six months before the reactor could be restarted. An updated *Safety Analysis Report* (SAR) would have to be approved by DOE, updated Technical Safety Requirements (TSR) would be developed based on the SAR, and an Operational Readiness Review would be completed as required by 10 CFR 830.110 (SARs) and 10 CFR 830.320 (TSRs).

The "Operational Readiness Review" mentioned in the previous paragraph ensures that the HFBR systems and administrative programs are ready to support reactor operation. The reactor is tested without fuel to make sure that the modifications work as designed, and checks are performed to make sure that all components were reinstalled correctly.

After all of the administrative procedures and readiness checks have been performed, if BNL were to then receive authorization to resume HFBR operations, all of the reactor operators would be retrained and re-certified, with special emphasis on any new procedures developed as the result of modifications to the HFBR. For example, new alarm systems have been installed, and operators will need to be trained so that they would know how to respond to a new alarm.

Only after all of the administrative approvals have been received and the operators retrained and re-certified would fuel be placed in the reactor core. There would be no operational delay involved with fuel manufacture; there is a two-to-three year supply of new fuel elements in storage at DOE's Oak Ridge National Laboratory in Tennessee. Shipping fuel elements from Tennessee to BNL would be a routine event, using procedures approved and safely used for 30 years.

2.1.2.2 60 MW Operation

Startup and operation of the reactor at a power level of 30 MW with a planned increase in operation of up to 60 MW (62 FR 62572).

Under this alternative, the reactor would resume operations at a power level of 30 MW with a planned increase in operation at a level of up to 60 MW. In fact, the reactor has operated in the past at a power level of 60 MW, from late 1982 to early 1989. A construction project was authorized on October 6, 1976 for increasing the intensity of the neutron beams from the reactor by increasing the thermal power of the reactor from 40 MW to 60 MW. The principal modification in this project was the replacement of the two primary heat exchangers by larger ones containing approximately 15 percent additional heat transfer surface.

The process of changing the power level from 30 MW to 60 MW is not complicated, and requires no equipment modifications. Fuel elements would need to be changed out more frequently, as the elements are depleted more quickly when higher neutron flux is maintained. As would be performed for 30 MW operation, and Operational Readiness Review would be conducted prior to startup.

2.1.3 RESUME OPERATION AND ENHANCE FACILITY ALTERNATIVE

Under this alternative, DOE would resume operation of the reactor at a power level of up to 60 MW and eventually the facility would be upgraded. This could entail the addition of scientific instruments, as well as replacement of the reactor vessel and beam tubes.

The following is a short list of what the enhancement of the HFBR might involve:

- Reactor Vessel Replacement — The existing vessel, experimental beam tubes, and reactor vessel internals would be removed and prepared for disposal. A new reactor vessel, including experimental beam tubes and reactor vessel internals, would be installed. While the current vessel would safely perform for another decade or longer, a new vessel could operate for another 30 to 40 years at 60 MW. The reactor vessel replacement would also improve experimental capabilities by allowing the installation of a larger thimble, located further into the reactor for the cold neutron facility, a refrigeration system used to reduce neutron energy to enhance research capabilities. This would allow more intensity, and allow access to five beams instead of three. The replacement reactor vessel would be of similar design and materials as the current reactor vessel.

- Cold Neutron Facility Enhancement — In conjunction with the reactor vessel replacement, a new H-9 cold neutron beam tube would be relocated closer to the core in order to increase the available low energy neutron flux.

- Instrumentation Upgrade — Additional instrumentation would be installed to support the facility users.

- Thermal Shield Replacement — The existing upper thermal shield would be removed, prepared for disposal and replaced with a new thermal shield. The replacement would be of similar design and material as the current shield.

While this alternative would be cost-effective, it should be noted that because of budget limitations, DOE regards the Resume Operation and Enhance Facility Alternative as a non-preferred alternative (62 FR 62572).

2.1.4 PERMANENT SHUTDOWN ALTERNATIVE

Under this alternative, the HFBR would be permanently shutdown for eventual decontamination and decommissioning (D&D). Since D&D is the eventual outcome of any reactor facility, it will eventually be necessary under any alternative. The fact that D&D is discussed under the Permanent Shutdown Alternative does not mean that D&D is not an eventual consequence in other alternatives; rather, it indicates that D&D would be more immediate should the Permanent Shutdown Alternative be selected by DOE. Additional NEPA review would be necessary in the future for a proposal for D&D of the reactor. This alternative would involve terminating the scientific research mission of the HFBR at BNL and placing the reactor in an industrially and radiologically safe condition for an extended period of time. This would be followed by D&D when funding is provided by Congress. While an analysis of the full and complete D&D is beyond the scope of this DEIS, the potential environmental impacts associated with D&D will be analyzed to the extent possible (62 FR 62572).

Transitioning the HFBR to permanent shutdown consists of deactivation and preparing for long-term storage and maintenance (S&M). Ideally, facility disposition activities begin with deactivation immediately after operation with the stabilization and removal of the facility's hazardous materials. These activities may include the removal of heavy water, flushing systems, and characterizing contamination.

Decommissioning activities follow deactivation. Detailed descriptions of these activities will not be known until a decision is made to permanently shutdown the HFBR, and D&D planning begins. These activities may include removing contamination and residual hazardous materials and reusing or dismantling facility systems and physical structures.

It is assumed that a period of long term S&M is conducted between facility operation, deactivation, and decommissioning. These long term S&M activities focus on monitoring and controlling any remaining hazardous materials or contamination, and maintaining the structural integrity of the facility.

The various phases of the HFBR disposition (deactivation, long-term S&M, and decommissioning) have different work objectives, desired end-points, and associated hazards that determine the set of requirements necessary to protect the safety and health of the workers and the public. For the purposes of this section, it is assumed that the HFBR will undergo complete dismantlement and that the individual pieces and components will be disposed of in an acceptable fashion. Other options are available, such as entombment, onsite disposal, and one-piece offsite disposal. D&D impacts will vary depending on the D&D option(s) selected and the time horizon chosen for consideration. Substantial amounts of chemicals also may be introduced for decontamination or other purposes.

2.2 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL

2.2.1 IMMEDIATE INITIATION OF REACTOR VESSEL REPLACEMENT FOLLOWED BY OPERATION AT 60 MW

Replacement of the reactor vessel before attempting startup was considered for several reasons:

- It would remove any concern about the metallurgical effects of further exposure to neutron and gamma radiation and extend the useful life of the facility.

- It could be less disruptive of the scientific program to replace the vessel at the same time that the spent fuel pool liner was being installed, if the two jobs could be carried out in one extended shutdown of the reactor.

- Re-design of one of the beam thimble tubes welded into the new vessel would permit the installation of a larger cold neutron source in a more optimal position in the reactor, allowing both an increase in the number of cold neutron beams and a six-fold increase in the cold neutron flux in each of these beams.

This alternative was not included in the DEIS because, while this project would be cost-effective, there are other demands for DOE funds. It was decided that the project was not financially feasible.

2.2.2 IMMEDIATE DECOMMISSIONING OF THE HFBR

Prompt decommissioning, as opposed to a long deactivation period, would likely result in significantly lower waste disposal costs, which have been rapidly spiraling upward over the past several years. This option would also avoid the costs of maintaining the facility in an industrially and radiologically safe condition for an extended period of time. However, this option was rejected for consideration in the DEIS, because it is unlikely that funding for a full D&D would be available in the near future. Furthermore, the analysis required to evaluate D&D alternatives will require characterization data that are not currently available.

2.2.3 CONVERSION OF THE HFBR BUILDING TO A NON-NUCLEAR FACILITY

A comment received during the scoping process requested consideration of conversion of the HFBR building into a non-nuclear facility to be used for researching techniques to clean contaminated groundwater. The present scope of the HFBR DEIS includes an alternative for the permanent shut down of the HFBR for eventual decontamination and decommissioning. If this alternative is selected, planning would be initiated and additional environmental evaluation conducted. Use of the HFBR building for non-nuclear activities may be considered at that time. Therefore, conversion of the HFBR building to a non-nuclear facility will not be analyzed in this DEIS.

2.2.4 RELOCATION OF THE HFBR OFF OF LONG ISLAND

A comment received during the scoping process requested consideration of relocating the HFBR off of Long Island and therefore, away from its sole source aquifer. About 5 years ago, DOE abandoned plans to build a new research reactor because of its cost (approximately three billion dollars). This new generation reactor would have eventually replaced existing neutron source reactors like the HFBR. It should be noted that DOE has proposed a new neutron beam facility, the SNS, to be built at Oak Ridge National Laboratory in Tennessee, with construction to start late in the year 2000. The SNS would produce neutrons like a reactor-based source of neutrons, such as the HFBR prior to its shutdown. However, the SNS uses pulsed accelerator technology to produce high energy neutrons for specific research applications whereas research that relies solely on integrated neutron flux requires the use of a reactor-based neutron source. DOE considers the SNS to be a complementary addition to neutron research, along with reactor-based neutron sources such as the HFBR. Therefore, relocation of the HFBR neutron research program will not be analyzed in this DEIS.

2.3 MODIFICATIONS TO THE HFBR

Regardless of the alternative chosen by DOE, the following specific repairs and modifications have been or will be made at the HFBR in order to comply with the Articles 7 and 12 of the Suffolk County Sanitary Code. These repairs and modifications will also enhance the structural integrity of structures required to assure environmental protection should a design-basis earthquake occur and ensure that there is no future tritium leakage to the groundwater. These repairs and modifications are not expected to be completed until some time in the year 2000.

2.3.1 REPAIR OF FLOOR JOINTS AND PENETRATIONS

Several floor joints and penetrations (including conduit, water and gas pipes, and other penetrations) in the floor of the HFBR have been repaired and sealed to ensure that there is no leakage path to groundwater from any accidental spill within the reactor confinement building. The potential for spills exists during both reactor operations and deactivation activities when there would be a need to move large quantities of radioactive liquids into tanks and drums for storage, treatment, or disposal (62 FR 62572).

The floor of the HFBR equipment level provides the primary support for the reactor structure and rests directly on soil above the water table. Floor areas contain numerous penetrations for drains, pipes, and conduits; the floor also contains construction joints between successive pours of concrete. Some leak paths were found at a few of the penetrations and floor joints. Seals around all penetrations, as well as the construction joints, have been repaired to eliminate potential pathways through which liquids spilled on the equipment-level floor can escape into the environment.

The large amount of radioactively contaminated water currently present in the building (approximately 45,500 l [12,000 gal]), even during shutdown, represents a potential hazard should it spill or leak onto the floor. This potential hazard would also exist during operations and during deactivation activities when there would be a need to move large quantities of radioactive liquids from storage, treatment, or disposal. In order to provide a barrier against accidental spills that could leak to groundwater, the integrity of the floor joint seals and penetrations must be maintained under all alternatives being analyzed in this DEIS (DOE 1998).

2.3.2 PIPING SYSTEMS AND SUMPS

Several piping systems and sumps in the HFBR will be modified and repaired by replacing single-walled piping and sumps with double-walled components, or installing new components above the floor, thus meeting the requirements of Suffolk County Sanitary Code, Article 7 and Article 12 for protection of groundwater. These systems would be used during operations and during deactivation activities to flush systems and reduce contamination (62 FR 62572).

Suffolk County Sanitary Code, Article 12 pertains to storage facilities and appurtenant piping above and below grade that contain hazardous material. The HFBR systems and equipment that contain hazardous materials include the primary purification system piping, the D_2O transfer piping and pumps, the D-Waste (liquid waste) piping and sump, the DA (D_2O) drain piping, and the spent fuel pool cooling system and coolant purification system.

In order to conform to Suffolk County Sanitary Code, Article 12, each of these underground storage facility systems will be modified by (1) replacing single-walled piping and sumps with double-walled components or (2) installing new components above the floor and suspending use of the corresponding components in or below the floor. Regardless of the future of the HFBR, these modifications are required to comply with Article 7 and Article 12 provisions to prevent leakage and ensure system integrity. For example, during deactivation activities, all tritiated heavy water would be drained from the vessel and other systems. System flushes would be required to reduce residual contamination levels, and light water would still be required for shielding purposes, lubrication, and cooling in cutting operations and to prevent the migration of radioactive particles throughout the plant (DOE 1998).

2.3.3 STACK DRAINS

The drains from the 106 m (350 ft) tall stack — which handles exhaust gases from the HFBR and other nearby facilities — will be repaired, along with the collection piping and sump, to convert them from single-walled to a double-walled system. This would enhance the confinement integrity of the HFBR by providing a barrier against potential accidental release of radioactive materials to groundwater (62 FR 62572).

A filtered exhaust path for air from the HFBR confinement building is provided by the stack located about 90 m (300 ft) west of the building. The stack also provides a discharge path for an airstream from the hot lab and other facilities. Rain falling into the stack and moisture condensing on the walls creates a tritium-contaminated downwash that must be drained from its point of accumulation at the bottom of the stack. This is currently accomplished by collecting the drain water in a sump and then pumping it to a holding tank. The existing stack collection piping and sump are single-walled and must be replaced by double-walled components in order to comply with the provisions of Suffolk County Sanitary Code, Article 12.

There are sufficient quantities of activated materials still remaining in the HFBR building that require confinement under all alternatives analyzed in the DEIS. Control and confinement of these activated materials for contamination control relies heavily on the integrity of the confinement system and the associated ventilation system that discharges through the stack (DOE 1998).

2.3.4 SEISMIC REINFORCEMENT

The HFBR control room and operations level crane will be reinforced to protect radiological monitoring and control systems, as well as operations personnel, in the event of a design basis earthquake (DBE). The control room and crane are needed to ensure safe reactor operations or deactivation activities (62 FR 62572).

The seismic strengthening of the control room and operations-level crane is an important environmental, safety, and health activity associated with all alternatives analyzed. While their failures would not result in damage to the reactor, and the facility design did not require them to withstand a design basis earthquake, strengthening the control room and operations level crane will assure the protection of operations personnel during a seismic event (BNL 1998). The protection of personnel during a seismic event is consistent with DOE policies regarding worker safety and best environment, safety, and health practice. Further, the Executive Order 12941, *Seismic Safety of Existing Federally Owned or Leased Buildings* (December 1, 1994), requires Federal departments and agencies to assess seismic safety of their buildings and to mitigate unacceptable seismic risks (DOE 1998). Several structures on the HFBR operations level may not withstand the effects of a design basis earthquake. The design basis earthquake is estimated to occur with a probability of 0.0002 per year. The vulnerable structures include:

The HFBR Control Room: The HFBR control room is a two-story unreinforced masonry block wall structure on the operations level. It is continuously staffed by operations personnel who closely observe and operate the facility's radiological monitoring and control systems.

The Operations-Level Crane: The crane is used primarily for reactor shutdown activities including moving large shielding blocks, heavy-shielded casks, and miscellaneous heavy equipment associated with the reactor and operations-level equipment. The crane would be used for similar purposes during deactivation activities. During standby periods, the crane is also used to move heavy equipment in support of maintenance activities. During reactor operation, it is used to move lead transfer casks to shield irradiated samples discharged from the HFBR irradiation facilities. Due to the proximity of the operations-level crane to the control room structure, failure of the crane as a result of seismic forces induced by the design basis earthquake could severely damage the control room and possibly injure the personnel there, as well as other personnel on the operations-level floor.

2.3.5 SPENT FUEL POOL LINER SYSTEM

A double-walled stainless steel liner will be constructed and installed in the spent fuel pool. The installation of this impervious liner and appurtenant piping, and leak detection system would result in the secondary containment of the HFBR spent fuel pool to ensure that the spent fuel pool would not be a source of groundwater contamination in the future. The spent fuel pool would be needed to store spent fuel during operations should the reactor be restarted and would be used to contain various radioactive reactor components which must be dismantled or cut apart in preparation for shipment offsite in the eventual D&D activities (62 FR 62572).

Spent fuel pool use under the No Action Alternative: While the NOI to prepare an EIS for the HFBR identified the liner as being needed for all alternatives except the No Action Alternative, subsequent review indicated that a liner would also be needed for this alternative. The spent fuel pool forms an integral part of the HFBR equipment-level floor whose integrity is essential to maintaining a barrier for preventing spilled or leaked liquids from escaping into the environment during a shutdown or defueled condition. Other potential leakage paths through underlying floor joints and penetrations are being repaired. Leak-tight integrity of the spent fuel pool and appurtenant piping is required to comply with the requirements of the Suffolk County Sanitary Code, Article 12.

Additionally, the liner is needed in order to comply with the *Final Action Memorandum Operable Unit III Tritium Removal Action* dated May 19, 1997, which requires all radioactive material in the spent fuel pool to be shipped offsite. All spent fuel was shipped offsite in September 1997. In order to quickly drain the spent fuel pool and eliminate it as the source of tritium in the groundwater, the control rod blades stored in the pool were placed into unlicensed shipping containers for temporary storage. Transfer of these control rod blades into licensed containers requires the use of the spent fuel pool to provide a shielded environment for the handling of these extremely radioactive control rod blades.

Installation of the proposed liner system will also provide the site with a Suffolk County Sanitary Code, Article 12-compliant storage facility in the event that any of those tanks at Building 801 developed a leak or were needed for the storage of other hazardous liquids. Overall, the installation of the liner system will reduce the radiation dose to workers and prevent further contamination of the groundwater during the use of the spent fuel pool under the No Action Alternative.

Spent fuel pool use under the Resume Operations Alternatives: Should any of the Resume Operations Alternatives be selected by DOE, the storage pool would be used to handle and temporarily store spent reactor fuel. In addition to spent fuel storage, the spent fuel pool would be used to store highly radioactive components that exceed requirements for offsite shipment and disposal. Such items are routinely stored for extended periods until radiation readings decay to acceptable handling, shipping, and disposal levels.

Spent fuel pool use under the Permanent Shutdown Alternative: In order to permanently shutdown the HFBR in preparation for eventual D&D, numerous reactor vessel internal components and highly radioactive shielding components will require removal. The HFBR was designed and constructed with a shielded chute that leads from the top of the reactor vessel to the bottom of the pool, providing a path for the safe removal of these components and irradiated fuel. The spent fuel pool allows for safe handling, storage, and packaging of highly radioactive components, many of which will need to be cut, dismantled, and placed into shielded containers for eventual offsite disposal. The water in the spent fuel pool is an integral component of the DOE “as low as reasonably achievable” (ALARA) approach to radiation protection because of its radiation shielding properties. The advantages of using water as a shielding medium include the fact that water is transparent and inexpensive, adapts to objects of any size and shape, and provides better control for preventing the spread of radioactive particulates into the air. The spent fuel pool also is the only large area within the HFBR facility designed to accommodate truck access and overhead crane clearance necessary for all types of D&D activities. The level of environmental and radiological safety provided by performing work activities utilizing a water-filled spent fuel pool and the associated ease of performing these activities in such an environment cannot be cost-effectively duplicated (DOE 1998).

2.4 COMPARISON OF ALTERNATIVES

A comparison of the environmental impacts of each of the alternatives considered is summarized in Table 2.4–1. The table presents the impacts to environmental resources associated with each of the alternatives considered. In addition, impacts associated with the No Action Alternative are included for a baseline comparison. The Table 2.4–1 format presents the impacts for each alternative by environmental resource analyzed.

2.5 PREFERRED ALTERNATIVE

The CEQ regulations require that an agency identify its preferred alternative, if one or more exist, in the DEIS (40 CFR 1502.14(e)). The preferred alternative is the alternative that the agency believes would fulfill its statutory mission, giving consideration to environmental, economic, technical and other factors. DOE does not have a preferred alternative at this time. DOE will continue to involve stakeholders in the EIS process so that stakeholder concerns can be considered and addressed. A preferred alternative will be identified in the FEIS. The ROD issued after the FEIS will describe DOE's decision on the future of the HFBR.

2.6 REFERENCES

40 CFR 1500 – 1508 CEQ, "Protection of the Environment: Regulations for Implementing the Procedural Provisions Of the National Environmental Policy Act," *Code of Federal Regulations*, Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office, Washington, DC, July 1, 1997.

62 FR 62572 (Volume 62 Federal Register page 62572), 1997, "Notice of Intent (NOI) for the Environmental Impact Statement for the High Flux Beam Reactor Transition Project at the Brookhaven National Laboratory, Upton, NY," Volume 62, Number 226, U.S. Department of Energy, Washington D.C., pp. 62572–62576, November 24.

BNL 1998 BNL, *HFBR Safety Analysis Report*, Draft, Reactor Division, Upton, NY, September 9, 1998.

DOE 1998 Memorandum, R. Lange to J. Kennedy, *Fiscal Year (FY) 1998 Program Guidance and Supporting Documentation for the High Flux Beam Reactor (HFBR) Spent Fuel Pool (SFP) Liner System*, July 9, 1998.

Table 2.4–1. Comparison of Alternatives

Resource	Alternative: No Action	30 MW	60 MW	Enhanced	Shutdown
Land Use/Visual	The exterior of the HFBR would not be modified. There would be no impact on current land use or visual resources.	Same as No Action	Same as No Action	Enhancement of the HFBR would not involve construction affecting the exterior of the facility. There would be no impact on current land use or visual resources.	Shutdown and long-term maintenance and surveillance would not affect the exterior of the HFBR. Eventual D&D may affect HFBR's exterior (visual resource) depending on the D&D approach selected (e.g., demolition), but land use would not be changed. Prior to D&D, there would be no impact on land use or visual resources.
Infrastructure	Electric power and steam use for HFBR equals 2% each of the BNL requirement (4,000 MWh/yr and $4.5x10^6$ kg/yr, respectively). Water use for the HFBR equals 1% (0.2 MLD) of BNL usage. These small percentages of site requirements do not represent a significant impact.	Electricity use would increase to 14,000 MWh/yr, a 5% increase in BNL consumption. Steam use would increase to $1.1x10^7$, a 2% increase over No Action. Water use for the HFBR would increase to 1.4 MLD, a 9% increase of BNL usage over No Action. These use rates are well within historic rates and site capacities. Therefore, these increases do not represent significant impacts.	Electricity use would increase to 14,000 MWh/yr, a 5% increase in BNL consumption. Steam use would increase to $1.5x10^7$, a 4% increase over No Action. Water use for the HFBR would increase to 2.8 MLD, an 18% increase of BNL usage over No Action. These use rates are well within historic rates and site capacities. Therefore, these increases do not represent significant impacts.	Electricity, steam, and water use rates during enhancement activities would not exceed use rates during operation. Operation rates would be the same increases as operation at 60 MW. These rates are well within historic usage and site capacities. Therefore, these rates do not represent significant impacts.	Long-term surveillance and maintenance activities require nearly identical electricity, steam, and water usage as current shutdown, which is approximately the same as No Action. Therefore, no significant impacts would be expected.

Table 2.4–1 Comparison of Alternatives — Continued.

Resource	No Action	30 MW	60 MW	Enhanced	Shutdown
	Alternative:				
Air Quality —— Radiological	Radiological air quality is assessed for impacts to human health: see Public and Occupational Health and Safety.	Radiological air quality is assessed for impacts to human health: see Public and Occupational Health and Safety.	Radiological air quality is assessed for impacts to human health: see Public and Occupational Health and Safety.	Radiological air quality is assessed for impacts to human health: see Public and Occupational Health and Safety.	Radiological air quality is assessed for impacts to human health: see Public and Occupational Health and Safety.
Air Quality —— Non-Radiological	Air emissions associated with restoration construction equipment, building heating, ventilation, and air conditioning (HVAC), and vehicle exhaust from routine deliveries would have a very small impact.	HVAC, vehicle exhaust from routine deliveries, and laboratory equipment emissions would have a very small impact.	Non-radiological air emissions would not increase as a result of increasing operational power from 30 to 60 MW. Therefore, HVAC, vehicle exhaust from routine deliveries, and laboratory equipment emissions would have a very small impact.	HVAC, vehicle exhaust from routine deliveries, and laboratory equipment emissions would have a very small impact.	HVAC, vehicle exhaust from routine deliveries, and laboratory equipment emissions would decrease after shutdown activities are complete.
Noise	Drilling of characterization wells for environmental restoration activities would be the major source of noise in the vicinity of the HFBR. Noise from drilling would not be audible at BNL site boundary. Continued shutdown of cooling tower operations would keep noise at reduced levels.	The primary source of noise would be from cooling tower operations. This noise would not be audible offsite, and impacts would be minor.	The primary source of noise would be from cooling tower operations. Noise levels would be similar to 30 MW operation, and impacts would be minor.	The primary source of noise would be from cooling tower operations. Noise levels would be similar to 30 MW operation, and impacts would be minor. Noise associated with enhancement activities would be primarily internal to the HFBR structure, and would have a minor impact on outdoor noise levels.	No noise from cooling tower operations would occur under shutdown or long-term surveillance and maintenance.

Table 2.4-1. Comparison of Alternatives — Continued.

Resource	Alternative: No Action	30 MW	60 MW	Enhanced	Shutdown
Water Resources —— Surface Water	Discharge from the HFBR to the Peconic River via the STP is about 0.15 MLD. Tritium concentration in STP discharges is about 1,350 pCi/l, well below the drinking water standard of 20,000 pCi/l. This low concentration of tritium is not a significant impact on surface water quality.	Discharge to STP would increase to about 0.27 MLD. Potential increase in tritium concentration in discharges to Peconic River via STP could be up to about 2,700 pCi/l. This would not represent a significant impact to Peconic River water quality.	Discharge to STP would increase to about 0.33 MLD. The concentration of tritium from the STP would be the same as under the 30 MW Alternative (about 2,700 pCi/l equals 14% of the drinking water standard). This would not represent a significant impact on Peconic River water quality.	Enhanced facility operation would discharge a level of tritium similar to 60 MW Alternative. This level would not represent a significant impact on Peconic River water quality.	Prior to D&D, discharge to STP would be the same as No Action. Following D&D there would be no discharges to the STP. No significant impacts would be expected.
Water Resources —— Groundwater	Modifications to the HFBR facility to comply with Articles 7 and 12 of Suffolk County Sanitary Code eliminated a major source of tritium contamination. The small amount of tritium that could leak from sanitary sewer lines connecting HFBR to the STP is not expected to have a significant impact on groundwater quality.	Low levels of tritium could leak from HFBR sewer lines, secondary cooling water system, and Recharge Basin HO. There are no in-service onsite supply wells located down gradient from the HFBR. The concentrations of tritium that could leak from the sewer lines or infiltrate from Recharge Basin HO would likely be very low, well below the drinking water standard of 20,000 pCi/l. No significant impact to groundwater quality would be expected.	Low levels of tritium could leak from HFBR sewer lines, secondary cooling water system, and Recharge Basin HO. Levels of tritium would be expected to be similar to 30 MW Alternative, and would not be expected to have a significant impact on groundwater quality.	Impacts to groundwater quality would be from the same sources and at the same levels as the 60 MW Alternative. Impact to groundwater would not be expected to be significant.	Removal of radioactive fluids would eliminate potential for leakage. Without the potential for leaks, there would be no impact on groundwater quality.

Table 2.4-1. Comparison of Alternatives — Continued.

Resource	Alternative: No Action	30 MW	60 MW	Enhanced	Shutdown
Geology	No new construction or ground-disturbing activities are planned that would impact soil or geologic resources.	Same as No Action	Same as No Action	Same as No Action	Shutdown would not involve construction or ground-disturbing activities. No impact to soil or geologic resources would occur.
Seismicity	The reactor building was designed for horizontal accelerations of 0.2 g. Maximum recorded acceleration in the area was 0.015 g. No active faults are known in the Long Island area, and no damage from seismic activity is expected.	Same as No Action	Same as No Action	Same as No Action	Same as No Action .
Ecological Resources —— Terrestrial Resources	No new construction or ground-disturbing activities would occur that could impact terrestrial resources.	No new construction or ground-disturbing activities would occur. Vegetation sampling from area surrounding BNL detected no radionuclides attributable to HFBR 30 MW operation air emissions. Therefore, no appreciable impacts to terrestrial resources would be expected.	No new construction or ground-disturbing activities would occur. Vegetation sampling from area surrounding BNL detected no radionuclides attributable to HFBR 30 MW operation air emissions. 60 MW operations would be expected to yield similar results. Therefore, no appreciable impacts to terrestrial resources would be expected.	No new construction or ground-disturbing activities would occur. Vegetation sampling from area surrounding BNL detected no radionuclides attributable to HFBR 30 MW operation air emissions. 60 MW operations would be expected to yield similar results. Therefore, no appreciable impacts to terrestrial resources would be expected.	No new construction or ground-disturbing activities would occur that could impact terrestrial resources.

Table 2.4-1. Comparison of Alternatives — Continued.

Resource	Alternative: No Action	30 MW	60 MW	Enhanced	Shutdown
Ecological Resources — Wetland Resources	No new construction or ground-disturbing activities would occur that could impact wetland resources.	No new construction or ground-disturbing activities would occur that could impact wetland resources. Air emissions would not be expected to appreciably impact wetland resources.	No new construction or ground-disturbing activities would occur that could impact wetland resources. Air emissions would not be expected to appreciably impact wetland resources.	No new construction or ground-disturbing activities would occur that could impact wetland resources. Air emissions would not be expected to appreciably impact wetland resources.	No new construction or ground-disturbing activities would occur that could impact wetland resources.
Ecological Resources — Aquatic Resources	HFBR wastewater discharges to the Peconic River via the STP contain low levels of tritium. Exposure doses from STP discharges would not exceed 1 rad/day, a DOE guideline expected to be protective of aquatic biota. Therefore, no appreciable impacts to aquatic resources would be expected.	No new construction would affect aquatic resources. Exposure doses from tritium levels in HFBR wastewater discharges via the STP and into Recharge Basin HO would not exceed 1 rad/day, a DOE guideline expected to be protective of aquatic biota. Therefore no appreciable impacts to aquatic resources would be expected.	No new construction would affect aquatic resources. At 60 MW operation (based on 1988 data from 60 MW operation), exposure doses from tritium levels in HFBR wastewater discharges via the STP and into Recharge Basin HO would not exceed 1 rad/day, a DOE guideline expected to be protective of aquatic biota. Therefore no appreciable impacts to aquatic resources would be expected.	No new construction would affect aquatic resources. At 60 MW operation (based on 1988 data from 60 MW operation), exposure doses from tritium levels in HFBR wastewater discharges via the STP and into Recharge Basin HO would not exceed 1 rad/day, a DOE guideline expected to be protective of aquatic biota. Therefore no appreciable impacts to aquatic resources would be expected.	Discharges to the Peconic River via the STP would eventually cease. Therefore any existing potential impacts would cease.

Table 2.4-1. Comparison of Alternatives — Continued.

Resource	Alternative: No Action	30 MW	60 MW	Enhanced	Shutdown
Ecological Resource —— Threatened and Endangered Species Habitats	No new land disturbing activities would impact Federal or State-listed endangered, threatened, or special concern species. Discharges to the Peconic River would not impact threatened, endangered, or special concern species as none are known to occur in the vicinity of the STP.	No new land disturbing activities would impact Federal or State-listed endangered, threatened, or special concern species. Discharges to the Peconic River and Recharge Basin HO would not impact threatened, endangered, or special concern species as none are known to occur in HO or in the vicinity of the STP.	No new land disturbing activities would impact Federal or State-listed endangered, threatened, or special concern species. Discharges to the Peconic River and Recharge Basin HO would increase over 30 MW operation, but would not impact threatened, endangered, or special concern species as none are known to occur in HO or in the vicinity of the STP.	Same as 60 MW Operation	No new land disturbing activities would impact Federal or State-listed endangered, threatened, or special concern species. Discharges to the Peconic River would cease. Therefore, no impacts to threatened, endangered, or special concern species would occur.
Cultural Resources	There would be no impact because no actions would disturb land or structures, and there are no known cultural resources or traditional cultural properties in the vicinity of the HFBR.	Same as No Action	Same as No Action	Same as No Action	Same as No Action
Socioeconomics	A total of 237 jobs (69 direct, 168 indirect) would continue, resulting in earnings of $21.5 million within the ROI. This is equal to 0.02% of both jobs and earnings within the ROI.	A total of 446 jobs (130 direct, 316 indirect)would be created, resulting in earnings of $37.9 million within the ROI. This is equal to 0.04% of both jobs and earnings within the ROI.	A total of 446 jobs (same as 30 MW operation) would be created, resulting in earnings of $37.9 million within the ROI. This is equal to 0.04% of both jobs and earnings within the ROI.	A total of 446 jobs same as 60 MW operation) would be created, resulting in earnings of $37.9 million within the ROI. This is equal to 0.04% of both jobs and earnings within the ROI.	A total of 319 jobs (93 direct, 226 indirect) would be temporarily created, resulting in earnings of $26.4 million within the ROI. This is equal to 0.03% of both jobs and earnings within the ROI.

Table 2.4-1. Comparison of Alternatives — Continued.

Resource	Alternative: No Action	30 MW	60 MW	Enhanced	Shutdown
Socioeconomics, continued		As many as 400 visiting scientists may also use the reactor annually. This may increase expenditures within the ROI.	As many as 400 visiting scientists may also use the reactor annually. This may increase expenditures within the ROI.	As many as 400 visiting scientists may also use the reactor annually. This may increase expenditures within the ROI.	
	Jobs would likely be filled by existing workforce. No impact on regional housing market or public services would occur.	Jobs would likely be filled by existing workforce. No impact to regional housing market or public services would occur.	Jobs would likely be filled by existing workforce. No impact to regional housing market or public services would occur.	Jobs would likely be filled by existing workforce. No impact to regional housing market or public services would occur.	Jobs would likely be filled by existing workforce. No impacts to regional housing market or public services would occur. Following D&D, the workforce would eventually become zero, which would have a slight adverse impact on the ROI economy.
Transportation —— Traffic	Traffic conditions would remain as they currently exist. No increase or decrease in impacts would occur.	Traffic from 130 employees and up to 400 visiting scientists would occur. Scientists would be expected to remain onsite. Employee and visitor traffic would be expected to have no appreciable impact on traffic.	Traffic related to employees (130) and visiting scientists (400) would not increase over 30 MW operations. Therefore, no appreciable impact on traffic would be expected.	Employee and visiting scientist traffic would be the same as 30 and 60 MW operation. Enhancement activities would add fewer than 100 vehicles per day. Because this represents less than 0.5% of the local traffic on William Floyd Parkway, no appreciable impacts would be expected.	Following permanent shutdown, it is anticipated that HFBR employees would be reassigned to other BNL research activities and facility maintenance. Therefore, no appreciable decrease in site traffic would occur.

Table 2.4-1. Comparison of Alternatives — Continued.

Resource	Alternative: No Action	30 MW	60 MW	Enhanced	Shutdown
Transportation —— Transport of Fuel Elements	All fuel elements were transported off-site in 1997. Therefore, there would be no impact.	At 30 MW, a shipping campaign would be expected approximately once every five years. Periodically, reactor vessel components and internal parts would be replaced and shipped offsite. Analysis in the SNF PEIS supports the conclusion that no major impacts would occur from offsite shipment of this volume of spent nuclear fuel.	At 60 MW, a shipping campaign would be expected approximately once every three years. Periodically, reactor vessel components and internal parts would be replaced and shipped offsite. Analysis in the SNF PEIS supports the conclusion that no major impacts would occur from offsite shipment of this volume of spent nuclear fuel.	Enhancement of the HFBR would not result in more nuclear fuel consumption than 60 MW operation. Transportation impacts would be similar to 60 MW operation, and would not be expected to be major.	No transportation impacts would occur because all spent fuel elements have been removed.
Public and Occupational Health and Safety — Radiological	<u>*Impacts to Public*</u>[a] Airborne releases would be approximately 27 Ci H^3 annually. All other radionuclides would have releases of <1 mCi. The population dose from HFBR air emissions would be 0.0098 person-rem/yr, which represents an estimated latent cancer fatality (LCF) risk of 4.9×10^{-6}.	<u>*Impacts to Public*</u>[b] Airborne releases would be approximately 98 Ci H^3 and 2 mCi of Br^{82} annually. All other radionuclides would have releases of <1 mCi. The population dose from HFBR air emissions would be 0.035 person-rem/yr, which represents an estimated LCF risk of 1.7×10^{-5}.	<u>*Impacts to Public*</u>[c] Airborne releases would be approximately 190 Ci H^3 and 3 mCi of Br^{82} annually. All other radionuclides would have releases of <1 mCi. The population dose from HFBR air emissions would be 0.069 person-rem/yr, which represents an estimated LCF risk of 3.4×10^{-5}.	<u>*Impacts to Public*</u> A prerequisite to HFBR reactor vessel replacement would be the removal of the existing vessel and internal components. Component segmentation depends on component activation. Components requiring segmentation, transportation, and shielding (approximately 23,000 kg) would involve approximately 800,000 Ci of total activity. Doses associated with handling this material would be determined by the method of segmentation, transportation, and shielding selected.	<u>*Impacts to Public*</u> During long-term surveillance and maintenance (S&M), doses would decrease slightly over time. Activities for S&M are similar to defueled reactor maintenance, and would be the same as the No Action Alternative.

Table 2.4-1. Comparison of Alternatives — Continued.

Resource	Alternative: No Action	30 MW	60 MW	Enhanced	Shutdown
Public and Occupational Health and Safety — Radiological, Continued	Total dose to the maximally exposed individual (MEI) from air and water would be $8.0x10^{-5}$ mrem/yr, which represents an estimated LCF risk of $4.0x10^{-11}$.	The total dose to the MEI from air and water would be $3.0x10^{-4}$ mrem/yr, which represents an estimated LCF risk of $1.5x10^{-10}$.	The total dose to the MEI from air and water would be $5.6x10^{-4}$ mrem/yr, which represents an estimated LCF risk of $2.8x10^{-10}$.	Operation of the reactor following enhancement would result in the same impacts as presented for 60 MW operation.	
	<u>*Impacts to Workers*</u> The average dose to workers would be 98 mrem/yr. The maximally exposed worker would receive 513 mrem/yr, which represents an estimated LCF risk of $1.9x10^{-3}$.	<u>*Impacts to Workers*</u> The average dose to workers would be 133 mrem/yr. The maximally exposed worker would receive 634 mrem/yr, which represents an estimated LCF risk of $5.5x10^{-3}$.	<u>*Impacts to Workers*</u> The average dose to workers would be 203 mrem/yr. The maximally exposed worker would receive 870 mrem/yr, which represents an estimated LCF risk of $8.4x10^{-3}$.	<u>*Impacts to Workers*</u> Enhancement activities would cause worker doses for this Alternative to increase in comparison to other Alternatives. Operation of the reactor following enhancement would result in the same impacts as presented for 60 MW operation.	<u>*Impacts to Workers*</u> Placement of the reactor in an industrially and radiologically safe condition would involve some worker dose from removal of radioactive systems and subsystems, equipment, and structures associated with the reactor. The doses would be expected to be similar to defueling activities. Impacts from S&M activities would be the same as for the No Action Alternative.
	All radiological doses to the public and workers related to air emissions and water discharges would be below levels established to protect human health.	All radiological doses to the public and workers related to air emissions and water discharges would be below levels established to protect human health.	All radiological doses to the public and workers related to air emissions and water discharges would be below levels established to protect human health.	All radiological doses to the public and workers related to air emissions and water discharges would be below levels established to protect human health.	All radiological doses to the public and workers related to air emissions and water discharges would be below levels established to protect human health.

Table 2.4-1. Comparison of Alternatives — Continued.

	Alternative:				
Resource	**No Action**	**30 MW**	**60 MW**	**Enhanced**	**Shutdown**
Public and Occupational Health and Safety ____ **Chemical**	No actions at the HFBR would be expected to introduce large quantities of chemicals.	Chemicals required for reactor operation (e.g., sulfuric acid for cooling water system conditioning, lithium chromate for corrosion inhibitor, and cadmium nitrate for poison water system) would remain. Hazards associated with these chemicals would have minor impacts.	The amounts of chemicals stored at the HFBR would be independent of the level of reactor power. Chemicals required for reactor operation (e.g., sulfuric acid for cooling water system conditioning, lithium chromate for corrosion inhibitor, and cadmium nitrate for poison water system) would remain. Hazards associated with these chemicals would have minor impacts.	No large quantity of chemicals would be expected to be introduced to the HFBR for enhancement purposes. Chemicals required for reactor operation (e.g., sulfuric acid for cooling water system conditioning, lithium chromate for corrosion inhibitor, and cadmium nitrate for poison water system) would remain. Hazards associated with these chemicals would have minor impacts.	Large quantities of chemicals are typically not introduced during deactivation activities. Chemicals not associated with deactivation would be reduced because they would no longer be needed. Chemicals such as sulfuric acid, cadmium nitrate and others would be removed. Impacts from the reduced chemical inventory would be small.

Table 2.4-1. Comparison of Alternatives — Continued.

	Alternative:				
Resource	**No Action**	**30 MW**	**60 MW**	**Enhanced**	**Shutdown**
Public and Occupational Health and Safety **____** **Accidents**[d]	No accidents involving nuclear fuel could occur in the defueled condition. Accidents involving D_2O coolant, experimental quantities of radionuclides, and contaminated portions of the facility would not be expected to result in significant airborne releases.	The severe wind/tornado is the scenario with the highest consequences[e]. The frequency of this event is 7.9×10^{-7} /yr.	The severe wind/tornado is the scenario with the highest consequences. The frequency of this event is 8.7×10^{-7} /yr.	Once enhancement activities are complete, the accident probabilities and consequences would not change from the 60 MW Alternative. Therefore the severe wind/tornado is the reasonably foreseeable scenario with the highest consequences. The frequency of this event is 8.7×10^{-7}/ yr.	Core damage accidents could not occur because there would be no fuel in the HFBR. A D_2O release could occur during a transition to a permanent shutdown state, but could not occur once the transition has been made. Accidents involving the release of D_2O or contaminated portions of the facility would not be expected to result in significant airborne releases.
		The estimated LCF risk to MEI would be 6×10^{-2} per accident occurrence, and 5×10^{-8} per year.	The estimated LCF risk to MEI would be 0.11 per accident occurrence, and 1×10^{-7} per year.	The estimated LCF risk to MEI would be 0.11 per accident occurrence, and 1×10^{-7} per year.	
		The estimated LCF risk to onsite noninvolved worker population would be 1.1 per accident occurrence, and 9×10^{-7} per year.	The estimated LCF risk to onsite noninvolved worker population would be 1.3 per accident occurrence, and 1×10^{-6} per year.	The estimated LCF risk to onsite noninvolved worker population would be 1.3 per accident occurrence, and 1×10^{-6} per year.	
		The estimated LCF risk to the offsite population would be 81 per accident occurrence, and 6×10^{-5} per year.	The estimated LCF risk to the offsite population would be 115 per accident occurrence, and 1×10^{-4} per year.	The estimated LCF risk to the offsite population would be 115 per accident occurrence, and 1×10^{-4} per year.	

Table 2.4-1. Comparison of Alternatives — Continued

Resource	Alternative: No Action	30 MW	60 MW	Enhanced	Shutdown
Waste Management —— Spent Nuclear Fuel	In the current defueled condition, the HFBR would generate 0 kg/year. There would be no impact associated with disposal of SNF.	Up to 77 fuel elements would be consumed annually. This amount of SNF would equal approximately 8% of BNL's storage capacity (1,000 elements). This would not have a significant impact on BNL's waste management operations.	Up to 158 fuel elements would be consumed annually. This amount of SNF would equal approximately 16% of BNL's storage capacity (1,000 elements). This would not have a significant impact on BNL's waste management operations.	Up to 158 fuel elements would be consumed annually (same as 60 MW operation). This amount of SNF would equal approximately 16% of BNL's storage capacity (1,000 elements). This would not have a significant impact on BNL's waste management operations.	No nuclear fuel would be delivered to or used in the HFBR.
Waste Management —— Liquid LLW	Sampling and maintenance operations would generate 80 m^3/year. BNL storage capacity is 265 m^3/yr. This generation rate is approximately 30% of BNL storage capacity, and would not have a significant impact on BNL's waste management operations. .	Same as No Action	Same as No Action	Same as No Action	Maintenance would result in 38 m^3/yr. Draining primary and support systems would result in a one-time generation of 80 m^3 which would likely be recycled for other research applications. The annual generation rates would be less than 15% of BNL's storage capacity, and would not be a significant impact on BNL waste management operations.

Table 2.4-1. Comparison of Alternatives — Continued

Resource	Alternative: No Action	30 MW	60 MW	Enhanced	Shutdown
Waste Management —— Solid LLW	Maintenance, surveillance, and monitoring operations would generate 23 m^3/year. This rate is approximately 4.3% of BNL's storage capacity (540 m^3/yr), and would not have a significant impact on BNL's waste management operations.	Research, monitoring, surveillance, and maintenance operations would generate 37 m^3/year. This rate is approximately 6.9% of BNL's storage capacity (540 m^3/yr), and would not have a significant impact on BNL's waste management operations.	More frequent fuel handling and numbers of fuel element cut ends would result in an increased generation rate over 30 MW operations. 42 m^3/year would be generated, which is approximately 7.8% of BNL's storage capacity (540 m^3/yr), and would not have a significant impact on BNL's waste management operations.	Replacement of the reactor vessel, experimental beam tubes, upper thermal shield, and reactor internals would result in a one-time generation of 30 m^3. After which, generation rates would be the same as 60 MW operation (42 m^3/year). This rate would be approximately 7.8% of BNL's storage capacity (540 m^3/yr), and would not have a significant impact on BNL's waste management operations.	Reduced maintenance, surveillance, and monitoring would generate 11 m^3/year, which is approximately 2.0% of BNL's storage capacity. A one-time operation to remove non-reactor components in preparation for D&D would generate 60 m^3. This rate would not have a significant impact on BNL's waste management operations.
Waste Management —— Mixed Waste	Routine maintenance would generate 1.3 m^3/year. This rate is approximately 6.8% of BNL's storage capacity (19 m^3/yr), and would not have a significant impact on BNL's waste management operations. .	HFBR operations would generate 1.7 m^3/year. This rate is approximately 8.9% of BNL's storage capacity (19 m^3/yr), and would not have a significant impact on BNL's waste management operations.	Same as 30 MW Operation	Same as 30 MW Operation	Removal of contaminated lead and beam plugs would generate 15 m^3 the first two years. 1.0 m^3/year would be generated thereafter from monitoring and surveillance activities. This generation rate is approximately 5.2% of BNL's storage capacity (19 m^3/yr), and would not have a significant impact on BNL's waste management operations.

Table 2.4-1. Comparison of Alternatives — Continued

	Alternative:				
Resource	**No Action**	**30 MW**	**60 MW**	**Enhanced**	**Shutdown**
Waste Management —— Hazardous Waste	Routine maintenance would generate 1.8 m^3/year. Hazardous waste is disposed of by a vendor on an as needed basis. This generation rate is approximately 1.5% of BNL's storage capacity (117 m^3/yr), and would not have a significant impact on BNL's waste management operations.	Routine maintenance would generate 2.4 m^3/year. Hazardous waste is disposed of by a vendor on an as needed basis. This generation rate is approximately 2.1% of BNL's storage capacity (117 m^3), and would not have a significant impact on BNL's waste management operations.	Same as 30 MW Operation	Same as 30 MW Operation	Removal of lead and other heavy metals during the first two years would generate 5 m^3. After that time, 1.0 m^3/year would be generated from monitoring and surveillance activities. Hazardous waste is disposed of by a vendor on an as needed basis. This generation rate is approximately 0.9% of BNL's storage capacity (117 m^3), and would not have a significant impact on BNL's waste management operations.
***Waste Management* —— Industrial Waste**	Routine maintenance would generate less than 1% of BNL's total. Industrial waste is disposed of by a vendor on an as needed basis. This generation rate would not have a significant impact on BNL's waste management operations.	Same as No Action	Same as No Action	Same as No Action	Same as No Action

Table 2.4-1. Comparison of Alternatives — Continued

Resource	Alternative: No Action	30 MW	60 MW	Enhanced	Shutdown
Environmental Justice	Because there would be no significant adverse socioeconomic or health impact on any offsite population, there would be no disproportionate adverse impacts to either low-income or minority populations.	Because there would be no significant adverse socioeconomic or health impact on any offsite population, there would be no disproportionate adverse impacts to either low-income or minority populations.	Because there would be no significant adverse socioeconomic or health impact on any offsite population, there would be no disproportionate adverse impacts to either low-income or minority populations.	Because there would be no significant adverse socioeconomic or health impact on any offsite population, there would be no disproportionate adverse impacts to either low-income or minority populations.	Because there would be no significant adverse socioeconomic or health impact on any offsite population, there would be no disproportionate adverse impacts to either low-income or minority populations.
Cumulative Impacts	Ongoing repair and maintenance actions at HFBR facilities that are unrelated to proposed alternatives will likely reduce the potential for future adverse impacts to groundwater. Under continued shut down status, HFBR incremental contribution to effects on radiological air quality, groundwater, human health, or radiological waste management capabilities would be bounded by (less than) operation at 60 MW, and would not result in significant cumulative impacts.	HFBR incremental contribution to impacts on radiological air quality, groundwater, human health, and radiological waste management capabilities would be bounded by (less than) operation at 60 MW, and would not result in significant adverse incremental or cumulative impacts. Other reasonably foreseeable future actions (e.g., the potential SNS) when added to HFBR waste generation rates would have significant adverse impacts on BNL waste management operations.	HFBR operation at 60 MW would include an incremental contribution to cumulative air quality impacts and subsequent impacts to Human Health. These impacts would not be significant incrementally or cumulatively. No incremental contribution to groundwater impacts would be expected. HFBR incremental contribution to radiological waste management impacts would not be significant. However, when added to other reasonably foreseeable future actions (e.g., the potential SNS), there would be a significant cumulative impact on BNL waste management operations.	Enhanced operation impacts would be expected to be the same as 60 MW operations. Significant cumulative impacts to BNL waste management operations would occur from other reasonably foreseeable future actions (e.g., the potential SNS) when added to HFBR's incremental contribution.	Shutdown impacts would be similar to No Action. Other reasonably foreseeable future actions (e.g., the potential SNS) would have significant cumulative impacts on BNL waste management operations when added to HFBR incremental contribution.

[a] Based on data in 1990 BNL *Site Environmental Report* when HFBR was operating at 0 MW.

[b] Based on data in 1995 BNL *Site Environmental Report* when HFBR was operating at 30 MW.

[c] Based on data in 1988 BNL *Site Environmental Report* when HFBR was operating at 60 MW.

[d] The four potential accident scenarios presented in detail in Chapter 4 of the DEIS include: 1) loss of offsite power (LOOP); 2) large loss of coolant accident (LOCA); 3) severe wind/tornado; and 4) fuel handling accident. For comparison, only the severe wind/tornado accident is presented because it depicts the highest consequences.

[e] Potential severe wind/tornado causes loss of offsite power, breaches confinement with a projectile and also eliminates then-existing coolant makeup. The release is not filtered because confinement is breached.